

Notice of Allowability

Application No.

10/051,339

Examiner

Wen-Tai Lin

Applicant(s)

LOLAYEKAR ET AL.

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to amendment filed 5/2/07.
2. ☒ The allowed claim(s) is/are 1, 3-6, 8-22, 24-25, 27-28, 30 and 33-44, renumbered as 1-37.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date 6/07
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

**EXAMINER'S AMENDMENT
AND
REASONS FOR ALLOWANCE**

1. An examiner's Amendment to the record appears below. Should the changes and/or additions be unacceptable, an amendment may be filed as provided by 37 C.F.R. 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the Issue Fee.

2. Authorization for the examiner's amendment was given in a telephone interview with Mr. Barry Young, reg. no. 27744, on June 20, 2007.

3. In the claims: please cancel claim 31 and amend claims 1, 9, 22, 25, 30, 33 and 37-38 to the following:

1. (Currently Amended) A method for use in a storage network, the storage network including at least one initiator, at least one storage device, and a storage switch having a linecard connected to the at least one initiator and the at least one storage device for communication with the at least one initiator and the at least one storage device, the method comprising:

providing, by the linecard of the storage switch, quality of service to the at least one initiator for accessing the at least one storage device in the storage network, wherein providing quality of service includes guaranteeing a minimum bandwidth to the at least one initiator to

access the storage device by estimating an actual bandwidth utilized by the initiator, where the actual bandwidth is estimated by a number of requests per second times an average size of requests from the at least one initiator, and wherein a request includes the packets sent back and forth between the at least one initiator and the at least one storage device necessary to complete the request.

9. (Currently Amended) A method for use in a storage network, the storage network including at least one initiator, at least one storage device, and at least one storage switch having a linecard, wherein the at least one initiator and the at least one storage device are both in communication with the linecard of the storage switch, the method comprising:

guaranteeing, by the linecard of the storage switch, a minimum bandwidth to the at least one initiator to access the at least one storage device in the storage network; and

estimating, by the linecard of the storage switch, an actual bandwidth utilized by the at least one initiator, where the actual bandwidth is estimated by a number of requests per second times an average size of requests from the at least one initiator, and wherein a request includes the packets sent back and forth between the at least one initiator and the at least one storage device necessary to complete the request.

16. (Currently Amended) A method for use in a storage network, the storage network including a plurality of initiators, a plurality of targets, and a storage switch having a linecard for communicating with the at least one initiator and the at least one storage device, the method comprising:

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guaranteeing, by the linecard of the storage switch, a respective minimum bandwidth for each of a plurality of connections, wherein each respective connection is a connection from a respective initiator to a respective target via the storage switch in the storage network;

monitoring, by the linecard of the storage switch, an actual bandwidth utilized by each initiator, where the actual bandwidth is estimated by a number of requests per second from the initiator times an average size of the requests from the initiator, where a request includes the packets sent back and forth between an initiator and a target necessary to complete the request;
and

determining if the actual bandwidth used by one initiator is excessive, and, if excessive, adjusting, by the linecard of the storage switch, a number of allowed concurrent requests for at least one initiator.

22. (Currently Amended) A method for use in a storage network, the storage network including at least one initiator, at least one storage device, and a storage switch having a linecard, wherein the at least one initiator and the at least one storage device are both in communication with the linecard of the storage switch, the method comprising:

providing a connection from the at least one initiator to the at least one storage device via the linecard of the storage switch in the storage network; and
adjusting, by the linecard of the storage switch, the number of requests allowed the at least one initiator to keep the bandwidth utilized by the at least one initiator within a specified range, wherein the bandwidth is estimated by a number of requests per second from the at least one initiator times an average size of the requests from the at least one initiator, and wherein a

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request includes the packets sent back and forth between the at least one initiator and the at least one storage device necessary to complete the request.

25. (Currently Amended) A switch for use in a storage network, the switch having a linecard comprising:

a port to be coupled to an external device, wherein the external device includes at least one of an initiator and a storage device; and
a bandwidth controller, the bandwidth controller including a processor, a traffic manager, and a buffer, for controlling bandwidth through the port by controlling a number of requests per second times an average size of the requests so as to keep the bandwidth utilized by the at least one initiator within a specified range, where a request includes the packets sent back and forth between the at least one initiator and the storage device necessary to complete the request.

30. (Currently Amended) A switch having a linecard, the linecard including:

a storage processor, including a request controller that estimates bandwidth by a number of requests per second times an average size of the requests, and wherein the request controller is designed to adjust the number of requests allowed to an initiator to keep the bandwidth utilized by the initiator within a specified range, where a request includes the packets sent back and forth between an initiator and a target necessary to complete the request;

a traffic manager in communication with the storage processor;

a buffer in communication with the traffic manager;

wherein if a specified threshold in the buffer is reached, the traffic manager is designed to activate the request controller to control the bandwidth.

33. (Currently Amended) A storage switch for use in a storage network, the storage switch having a linecard comprising:

a first port to be coupled to at least one initiator;

a second port to be coupled to at least one storage device; and

means for providing quality of service for a connection from the at least one initiator to the at least one storage device in the storage network, comprising:

means for guaranteeing a minimum bandwidth to at least one initiator to access a storage device; and

means for estimating an actual bandwidth utilized by the at least one initiator, where the actual bandwidth is estimated by the number of requests per second times the average size of the requests from the at least one initiator, and where a request includes the packets sent back and forth between the at least one initiator and the storage device necessary to complete the request.

37. (Currently Amended) A storage network, including:

an initiator;

a storage device;

a switch having a linecard in communication with the initiator and the storage device;

wherein the linecard of the switch includes a traffic manager in communication with a buffer;

wherein when the buffer includes a number of packets from the initiator that exceeds a specified threshold, then the switch is designed to notify the initiator to reduce a number of concurrent requests, and where a request includes the packets sent back and forth between the an initiator and a target necessary to complete the request.

38. (Currently Amended) A machine readable media which has instructions stored thereon, which when executed on a linecard of a storage switch in a storage network including an initiator and a storage device in communication with the linecard of the storage switch causes the linecard of the storage switch to perform the following steps:

guaranteeing a minimum bandwidth to the initiator to access the storage device in the storage network; and

estimating an actual bandwidth utilized by the initiator, where the actual bandwidth is estimated by a number of requests per second times an average size of requests from the initiator, where a request includes the packets sent back and forth between the initiator and the storage device necessary to complete the request.

4. The following is an examiner's statement of reasons for allowance:

The prior art of record does not teach or suggest individually or in combination a method/device for providing quality of service (QoS) in a storage network implemented on a line card of a storage switch. The storage network QoS guarantees a minimum bandwidth to an initiator by adjusting/throttling the initiator's concurrent requests by estimating the utilized bandwidth to determine whether the ongoing requests have exceeded certain pre-determined limits, wherein

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the bandwidth is estimated based on the average size of an initiator's request times the frequency of requests (i.e., number of requests per second) and the size of a request is obtained by counting the packets sent back and forth between the initiator and the storage device necessary to complete the request.

Conventional QoS in a storage network normally sets an ingress point at a point closer to the initiator and an egress point positioned close to the storage devices for adjusting the traffic at the ingress point based on the measured traffic at the egress point, or vice versa, wherein the traffic rate is normally measured in terms of number of packets per second or bytes per second without concerning the total amount of packets in each request, while the traffic is likewise adjusted by controlling the amount of packets per second (or bytes per second). Thus the main thrust of the instant application is two-fold: (1) it is a single-point QoS implementation: the traffic regulator and traffic estimator both reside on the same line card of a storage switch; and (2) estimation of the utilized bandwidth is based on the accumulated traffic volume within each request and the traffic regulation is attained by throttling the number of requests from each initiator.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wen-Tai Lin whose telephone number is (571)272-3969. The examiner can normally be reached on Monday-Friday(8:00-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on (571) 272-1915. The fax phone numbers for the organization where this application or proceeding is assigned are as follows:

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(571)273-8300 for official communications; and

(571)273-3969 for status inquires draft communication.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Wen-Tai Lin

June 22, 2007

Wen-Tai Lin
6/24/07